

# CalNex 2010

## Study Overview

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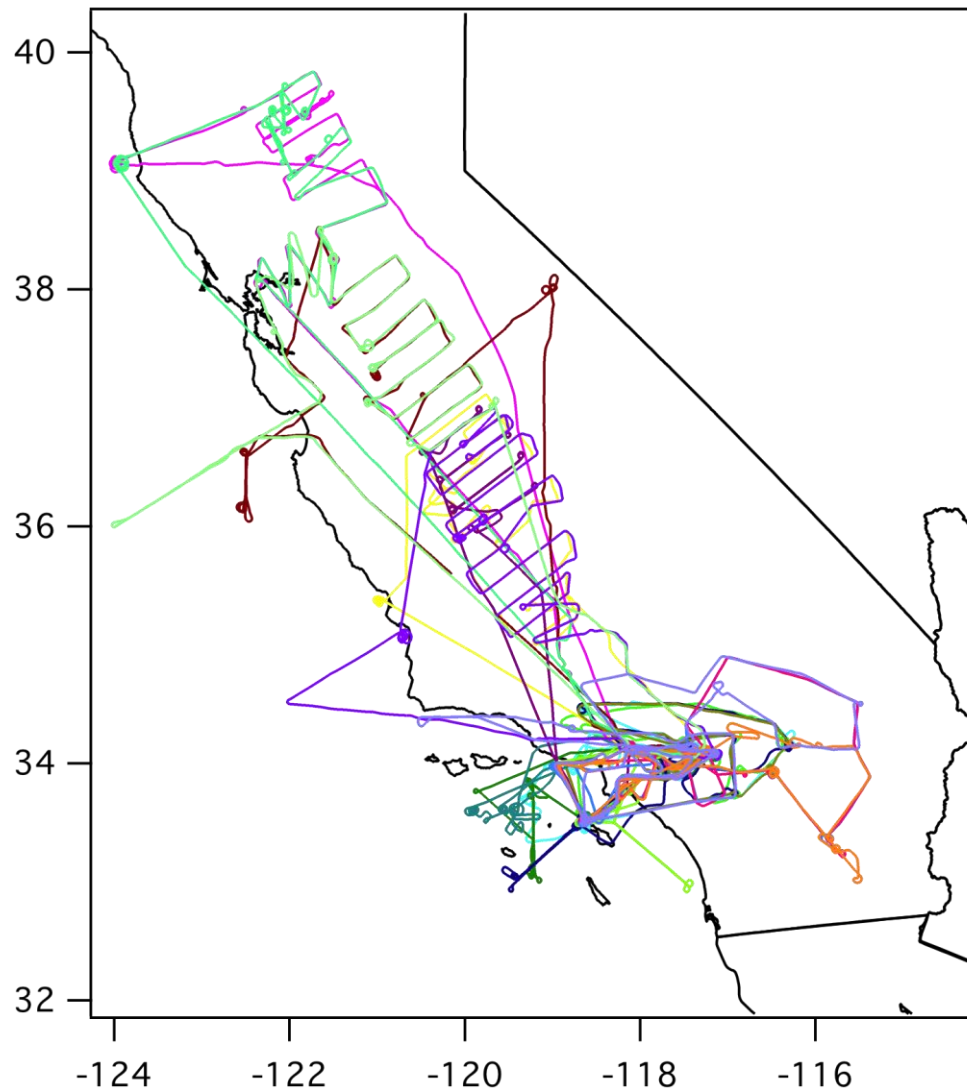
Major field study in May-June 2010

Led by ARB and NOAA; many  
partners with independent goals  
*University researchers, NASA,  
DOE, NSF, NRL, USFS, NPS*

Surface-, aircraft-, ship-, and  
space-based measurements;  
complemented by Lagrangian and  
Eulerian modeling studies

*Building on decades of existing  
research in California*

### CalNex NOAA P-3 flight tracks

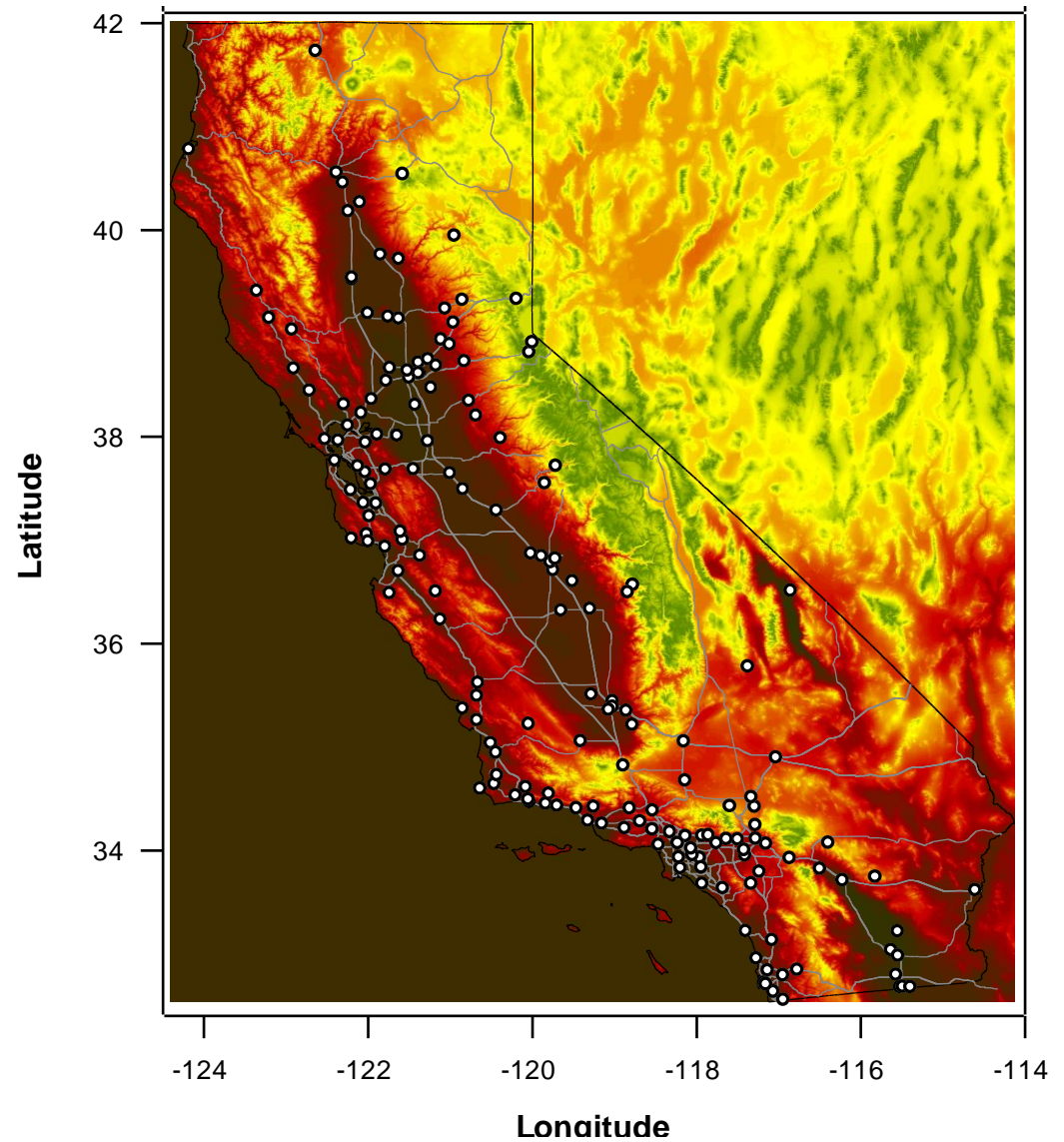


# CalNex 2010

## Measurements during CalNex:

Long-term surface observations

## Ground-based monitoring stations



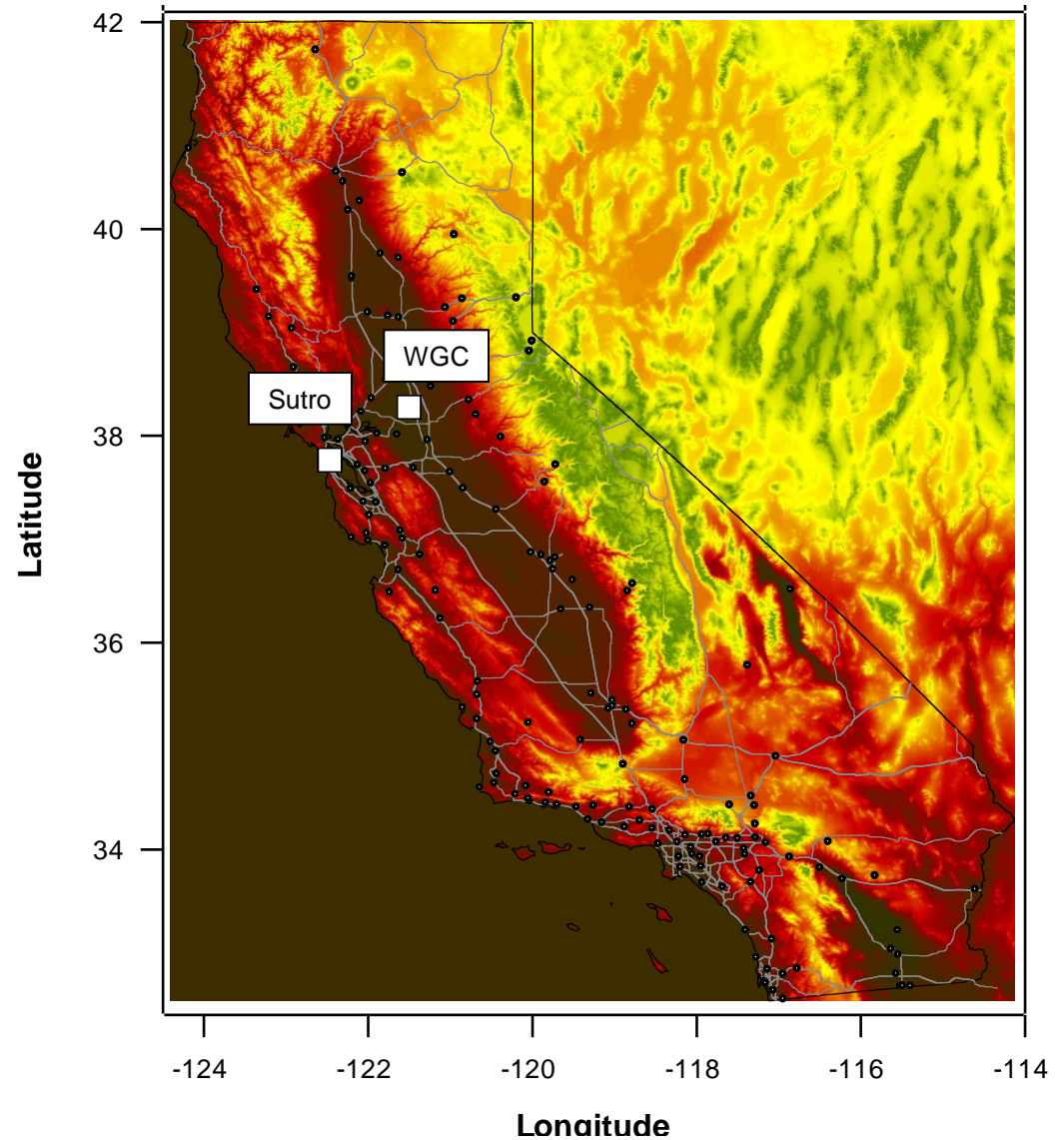
# CalNex 2010

## Measurements during CalNex:

Long-term surface observations

Instrumented tall towers

## CALGEM (LBNL/NOAA) tall tower sites



# CalNex 2010

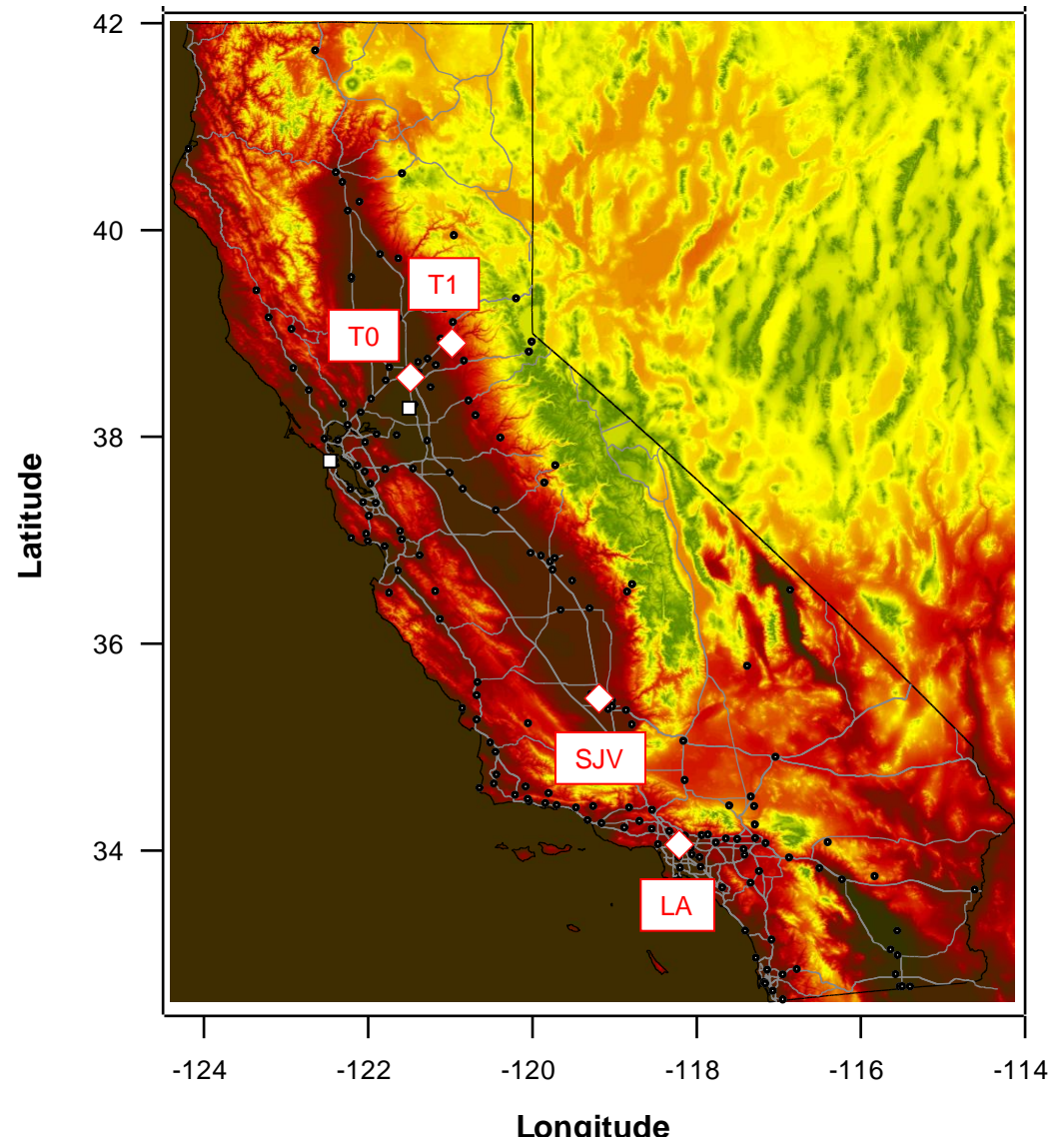
## Measurements during CalNex:

Long-term surface observations

Instrumented tall towers

Major intensive ground sites

## CalNex and CARES major ground sites



# CalNex 2010

## Measurements during CalNex:

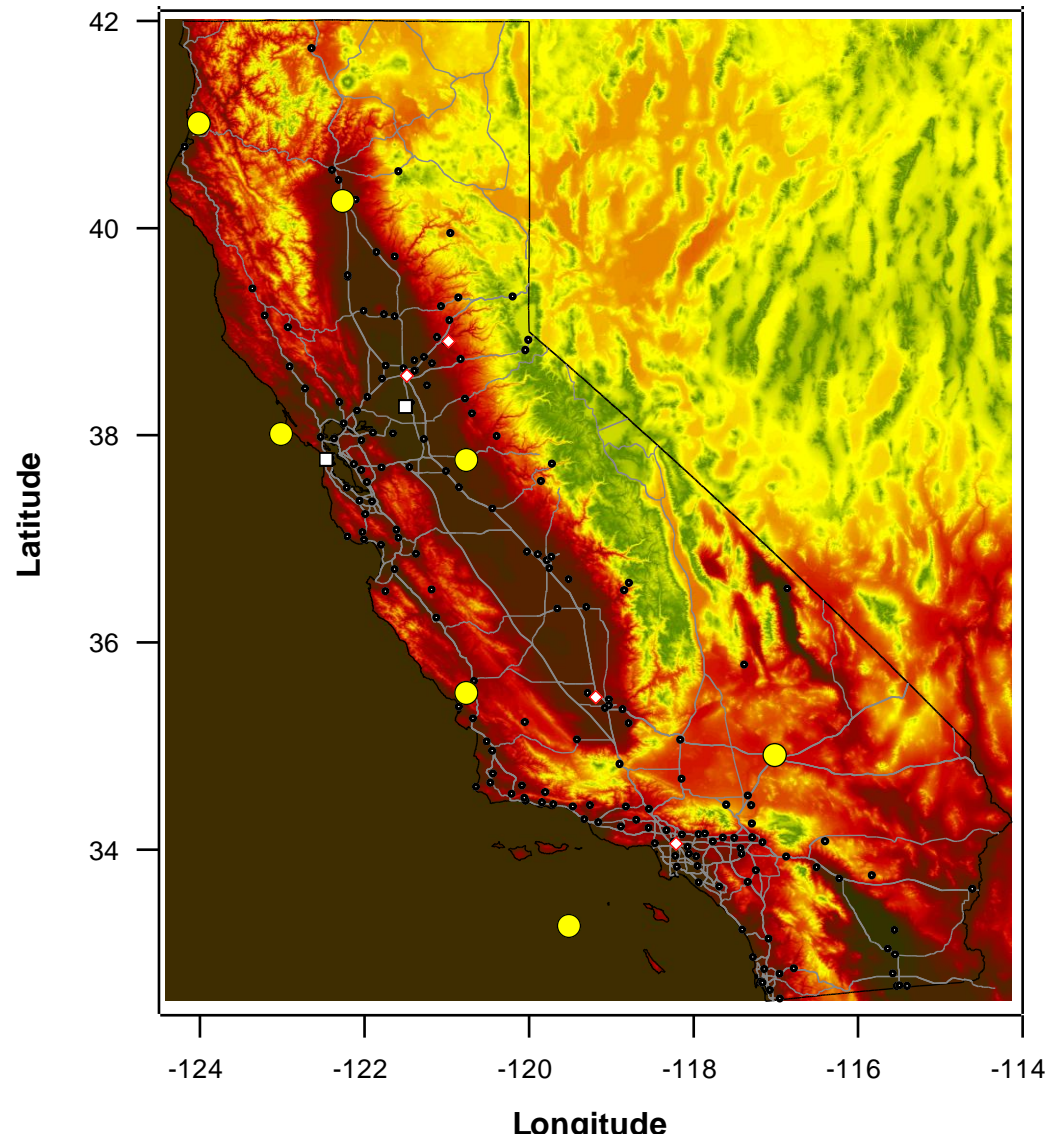
Long-term surface observations

Instrumented tall towers

Major intensive ground sites

Daily ozonesonde launches

## IONS-2010 ozonesonde network



# CalNex 2010

## Measurements during CalNex:

Long-term surface observations

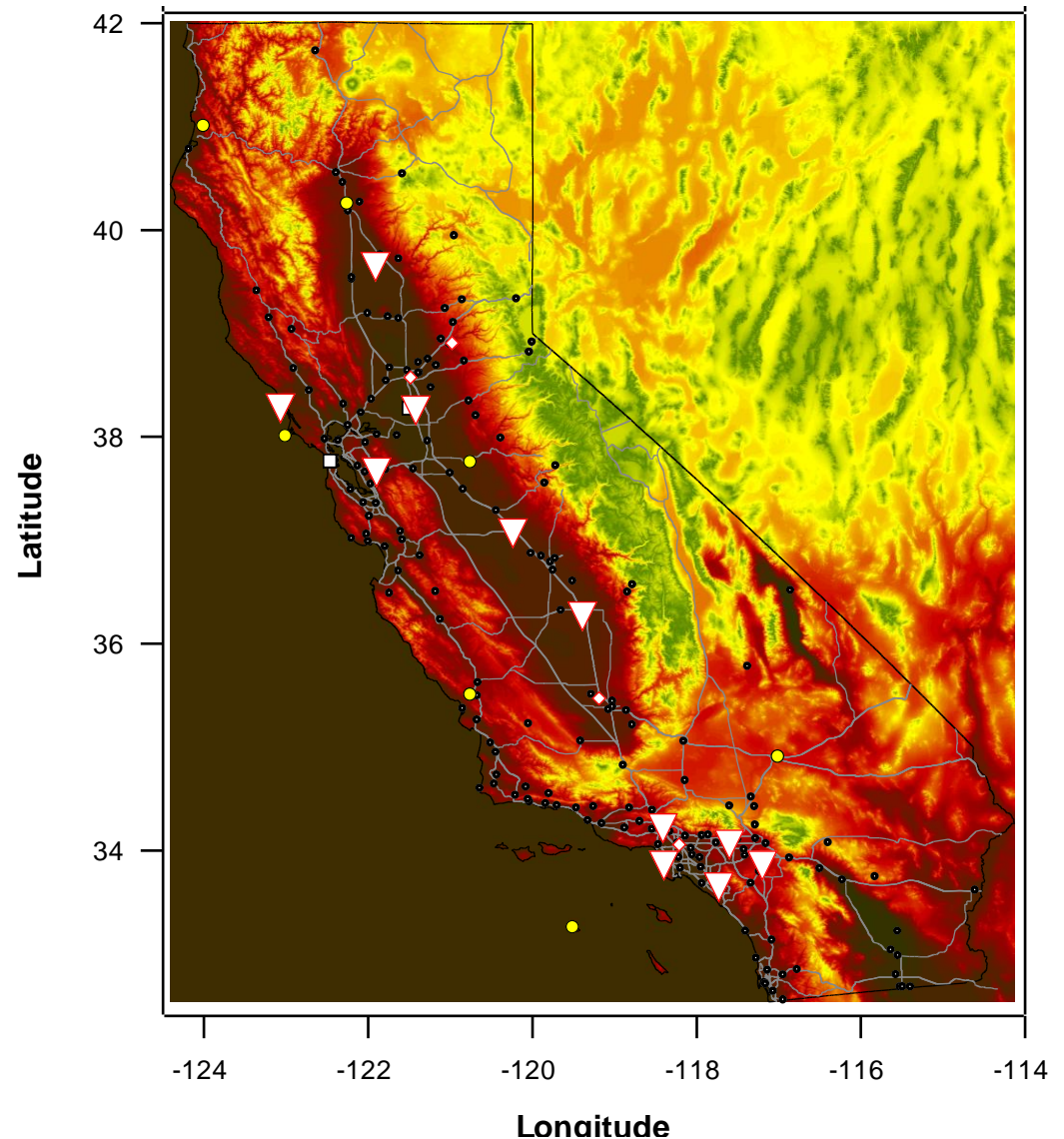
Instrumented tall towers

Major intensive ground sites

Daily ozonesonde launches

Radar profiler network

## Upper-air profiling sites



# CalNex 2010

## Measurements during CalNex:

Long-term surface observations

Instrumented tall towers

Major intensive ground sites

Daily ozonesonde launches

Mobile research platforms

NOAA WP-3D & Twin Otter

CIRPAS Twin Otter

NASA King Air

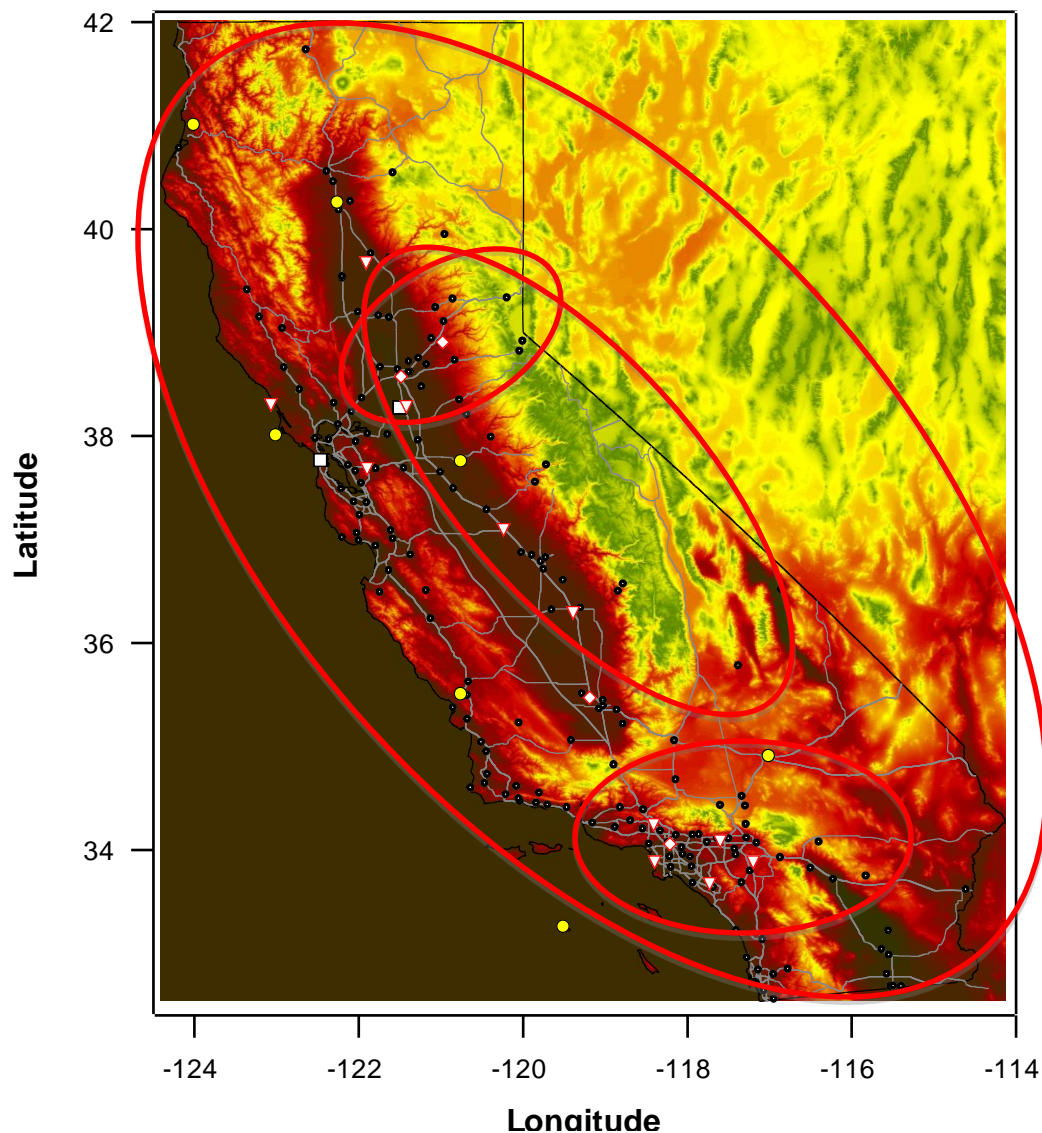
DOE G-1

R/V *Atlantis*

Satellite observations

TES, OMI, Sciamachy, IASI

## CalNex and CARES aircraft operations



# NOAA WP-3D payload - CalNex 2010

<i><u>Instrument</u></i>	<i><u>Measurement</u></i>	<i><u>Time resolution</u></i>
O <sub>3</sub>	ozone	1 sec
CO	carbon monoxide	1 sec
SO <sub>2</sub>	sulfur dioxide	3 sec
CO <sub>2</sub> and CH <sub>4</sub>	carbon dioxide and methane	1 sec
AWAS	VOCs, halocarbons, alkyl nitrates	72/flight
PTRMS	oxy-VOCs, aromatics, acetonitrile	15 sec
HCHO	formaldehyde	1 sec
NO, NO <sub>2</sub> , and NO <sub>y</sub>	nitrogen oxides	1 sec
PANs and ClNO <sub>2</sub>	peroxyacyl nitrates and nitryl chloride	1 sec
NO <sub>3</sub> and N <sub>2</sub> O <sub>5</sub>	nocturnal nitrogen oxides	1 sec
HNO <sub>3</sub>	nitric acid	
NH <sub>3</sub>	ammonia	1 sec
LTI	aerosol low turbulence inlet	1 sec
NMASS/UHSAS/WLOPC	0.004 to 8 μm aerosol size distribution	1 sec
CRD-AES	3-λ aerosol extinction as f(RH)	1 sec
PSAP	3-λ aerosol absorption (filter)	15 sec
PAS	3-λ aerosol absorption (photoacoustic)	5 sec
SP2	aerosol black carbon	1 sec
PILS	aerosol chemical composition	80/flight
AMS	aerosol chemical composition	10 sec
UV-VIS spectrometer	spectral actinic flux from 280-689 nm	1 sec
TDL H <sub>2</sub> O	water vapor	1 sec
cloud probes	drop size and morphology	1 sec
position and meteorology	aircraft location, T, P, winds, etc.	1 sec

Emissions  
evaluation  
will be a focus  
in CalNex

*anthropogenic*

*biogenic*

*biomass burning*  
1 sec

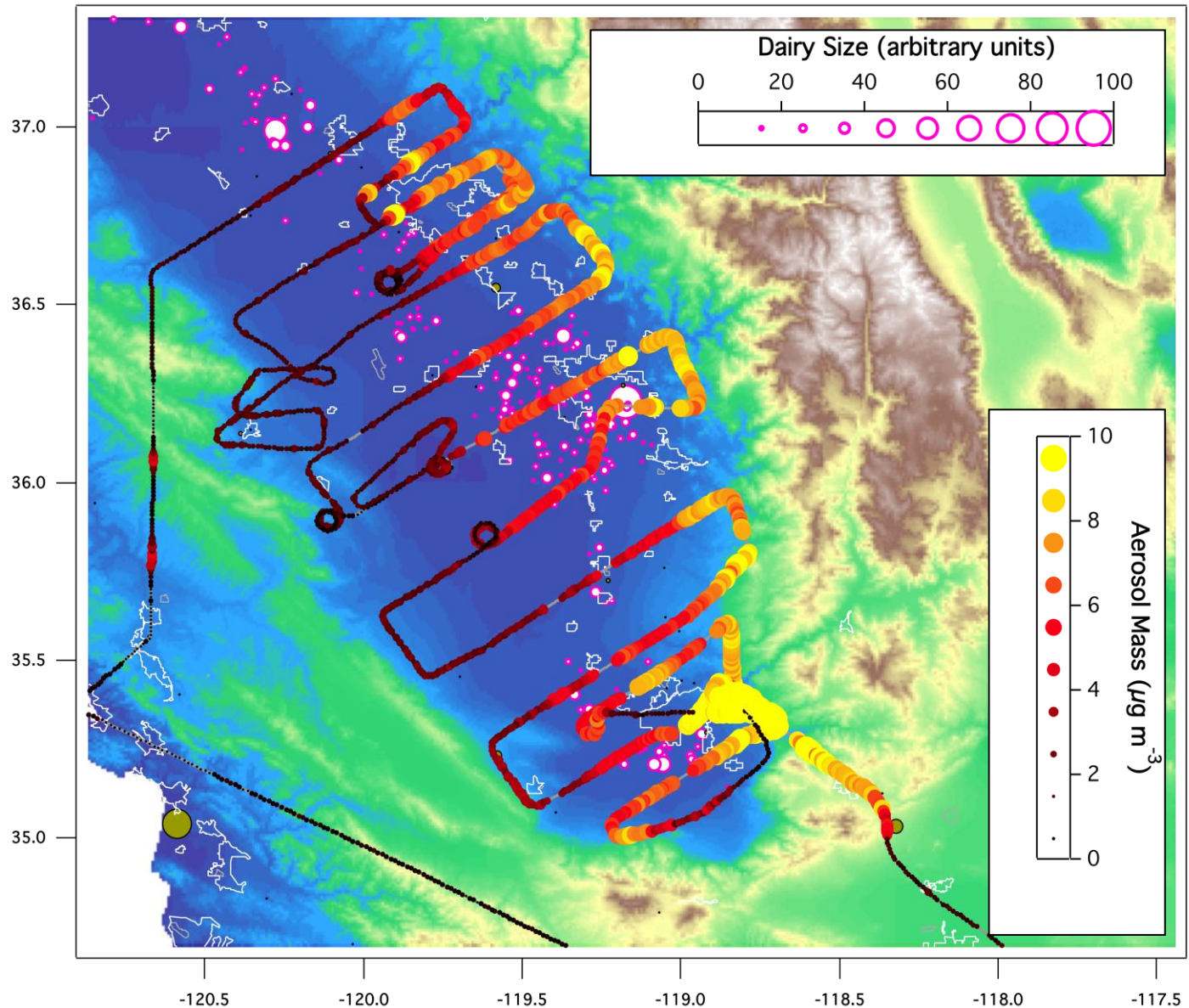
*agricultural*

*GHGs  
and  
soot*



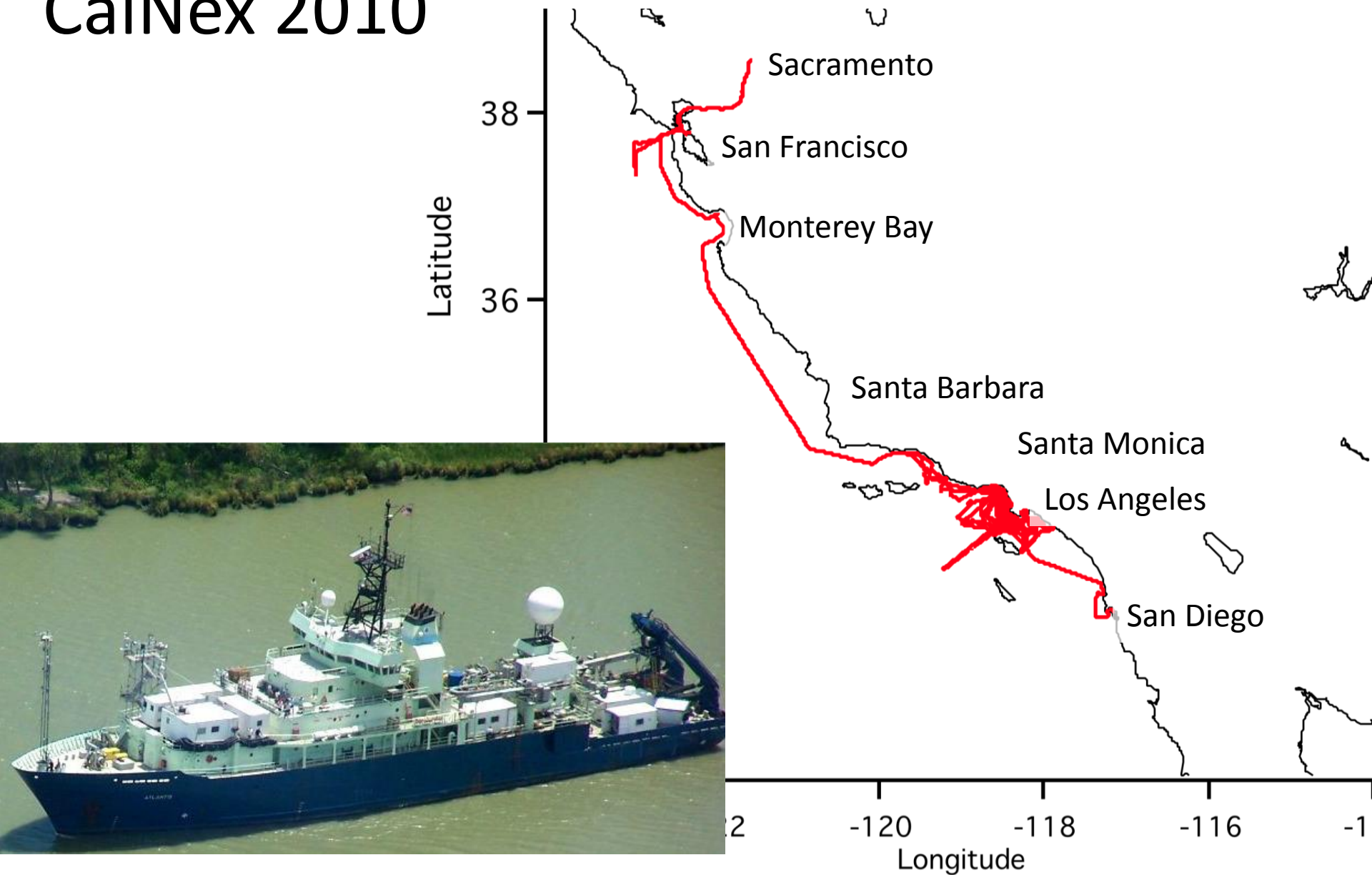
*short-lived  
species linking  
AQ and climate*

# NOAA WP-3D flight on 2010/05/07 in San Joaquin Valley



Courtesy of Chuck Brock

# CalNex 2010

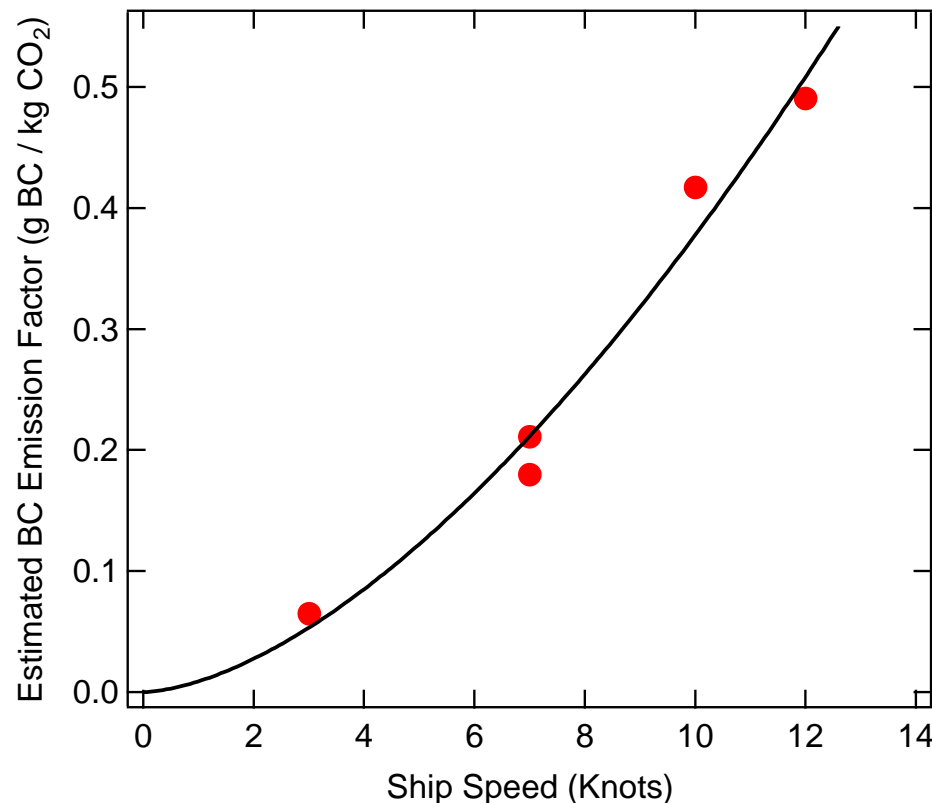
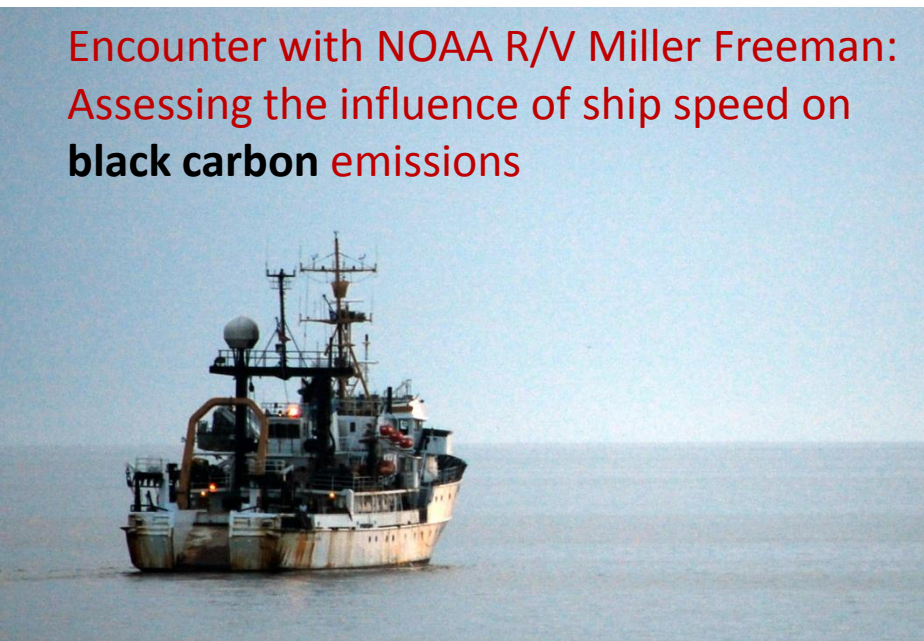


Courtesy of Trish Quinn

## Preliminary results from measurements onboard RV Atlantis:

- Particle production occurred in the Sacramento region during morning hours as ion clusters formed particles followed by growth due to condensation of organic vapors.
- Marine vessels within 24 miles of shore appear to be in compliance with the low sulfur fuel regulations implement by the California Air Resources Board.
- Joint work with the NOAA RV Miller Freeman indicates that the BC emissions factor increases with ship speed.

Encounter with NOAA R/V Miller Freeman:  
Assessing the influence of ship speed on  
black carbon emissions



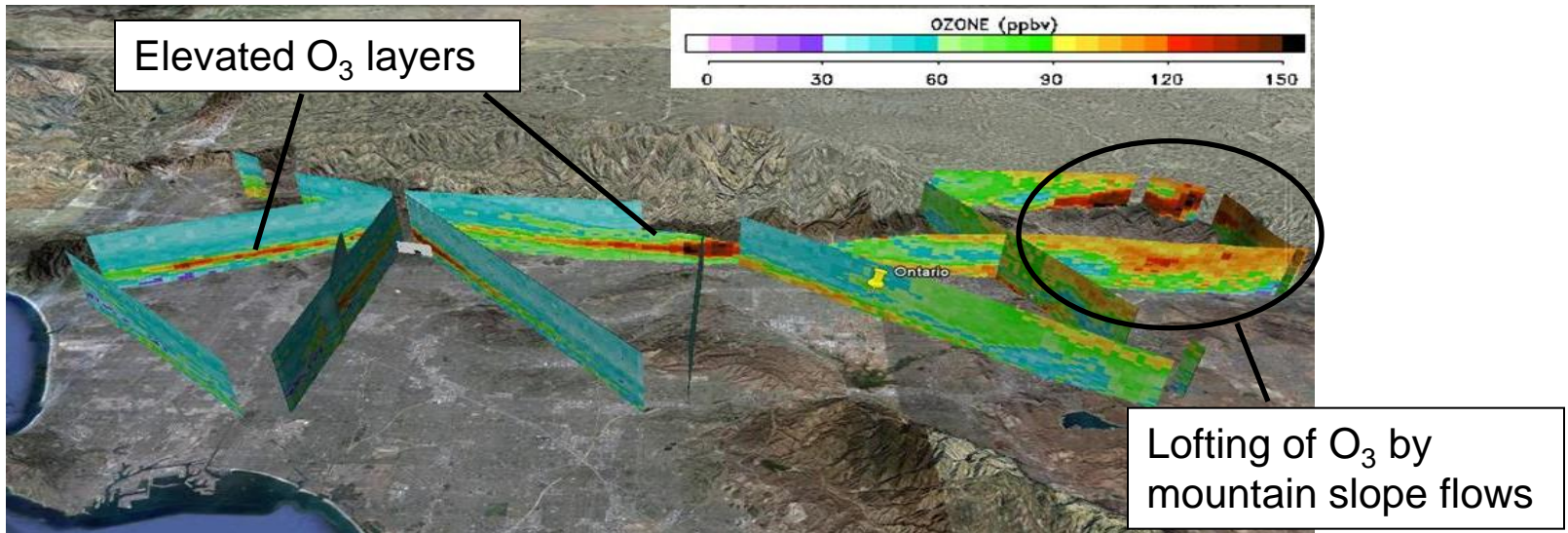
# NOAA Twin Otter CalNex 2010 Summary

- Deployment dates: May 19 – July 19, 2010
- Key Objectives
  - Horizontal/vertical pollution transport
  - Three-dimensional pollution distribution and model validation
- Operational Areas: Los Angeles, Southern California, Sacramento area, Central Valley, CA-Mexico border
- Primary instruments:
  - Downward-looking ozone and aerosol lidar (TOPAZ)
  - Airborne Multi-Axes Differential Optical Absorption Spectroscopy (AMAX-DOAS) Instrument
  - University of Leeds Doppler wind lidar



Courtesy of Mike Hardesty

# Preliminary Data Example showing wind and O<sub>3</sub> layering

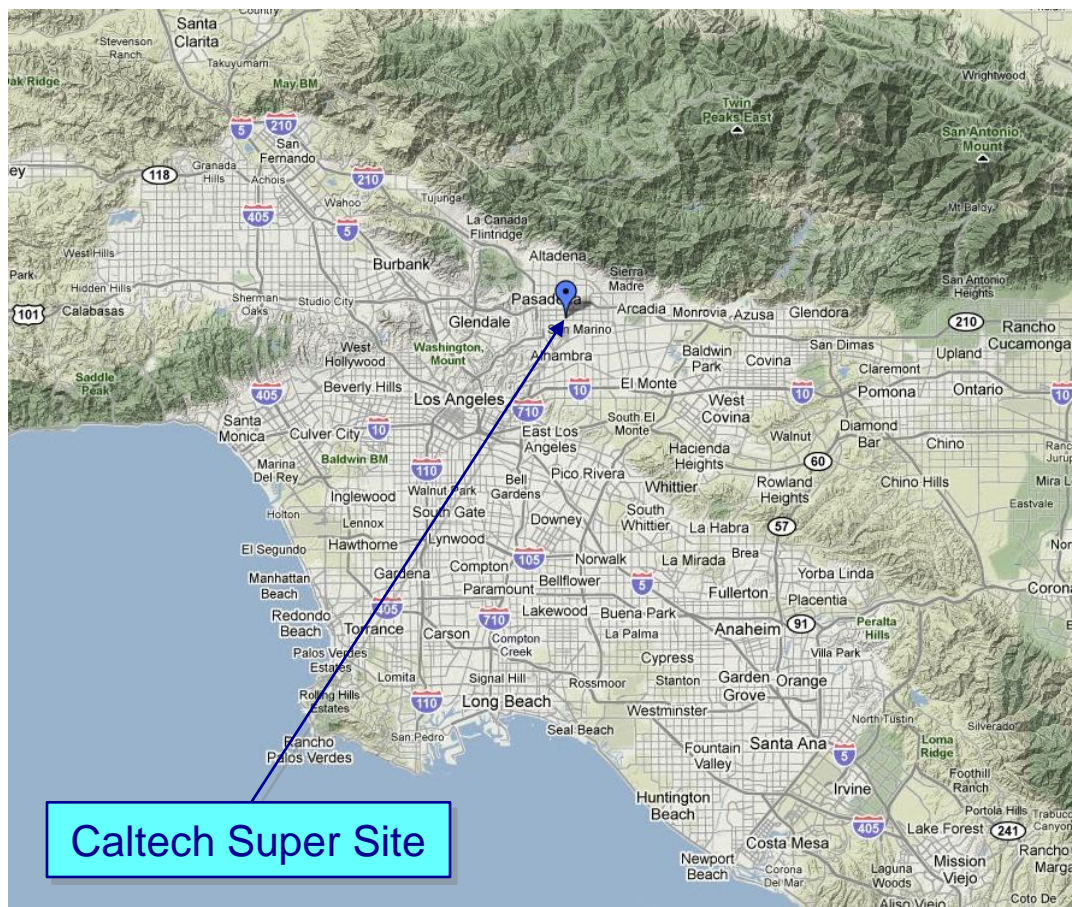


15 July 2010: Complex 3-D distribution of O<sub>3</sub> over the LA Basin



15 July 2010: Complex 3-D distribution of wind speed over the Basin

# CalNex Super Site at Caltech



- Extensive suite of gas-phase and aerosol measurements
- Campus of Caltech
- May 15 – June 16, 2010

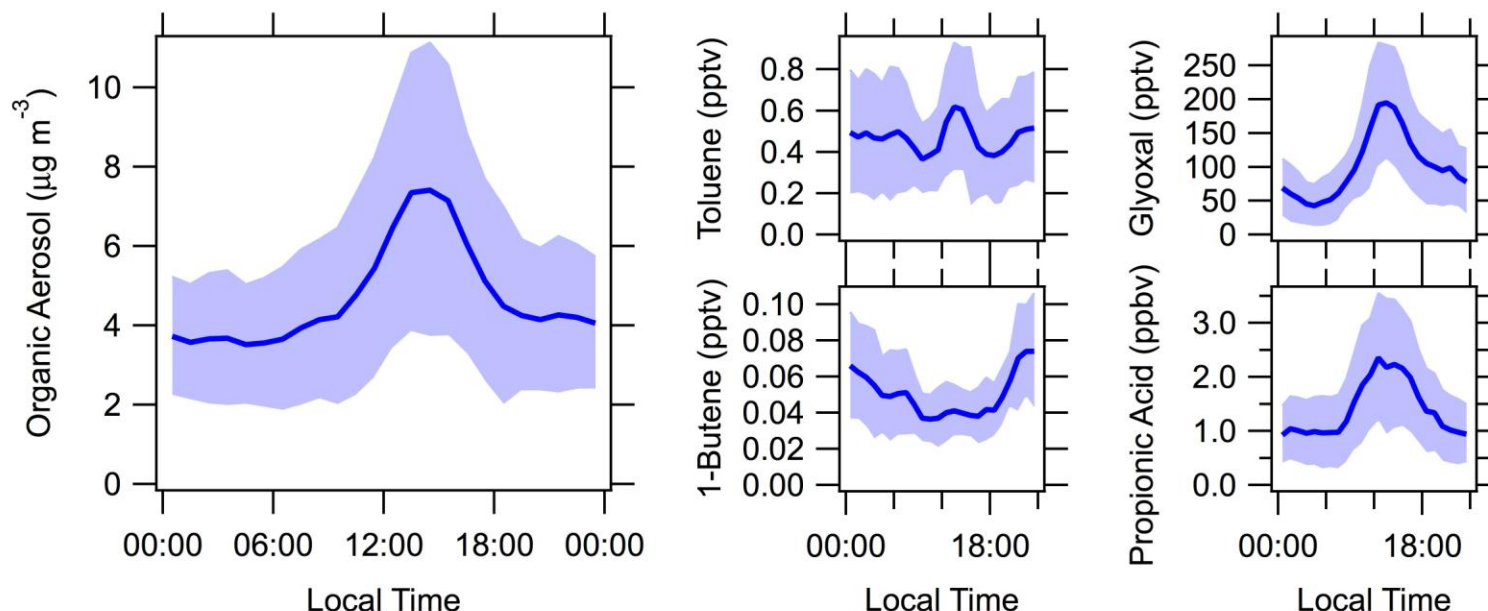


Science goals: Formation of secondary organic aerosol (SOA) in urban air  
Nighttime and early-morning processing of urban emissions  
and many, many others

Courtesy of Joost deGouw

# CalNex Super Site at Caltech

Average diurnal variations in a few selected species:

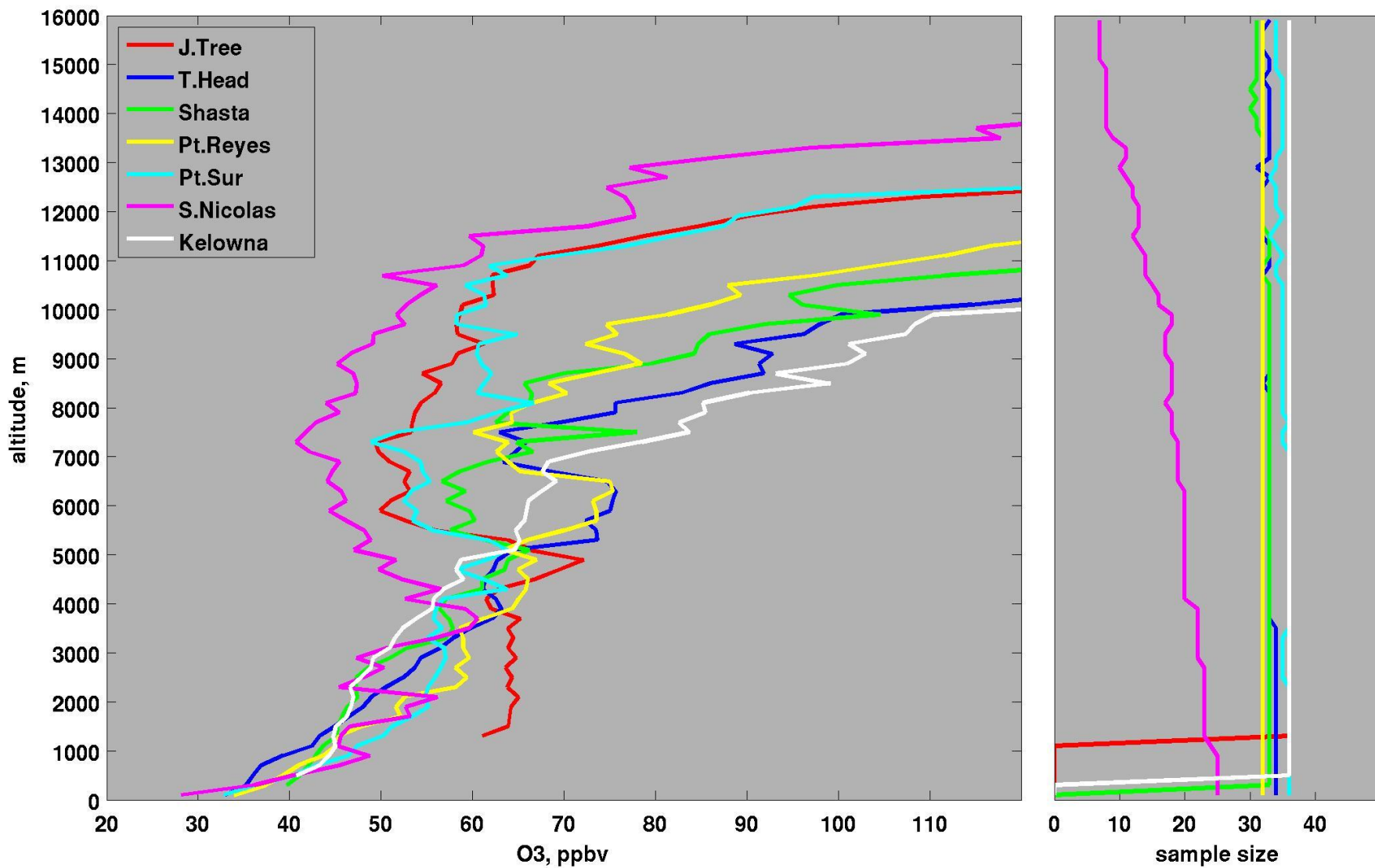


## Preliminary findings:

- Most reactive HCs maximize at night: local, unprocessed emissions
- Organic aerosol, other photoproducts and less reactive HCs maximize in the early PM: transport of processed air from LA

# CalNex / IONS Median Profiles May – June 19

## Preliminary Data



Courtesy of Owen Cooper